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( **Repackaging of**  
**Digital Display Unit, DR-1** )

25X1

Published March 1962

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## Discussion

This portion of the Digital Display Unit, DR-1, proposal contains technical discussion on research and development for repackaging of internal portions of the DR-1 Unit.

Very little extra effort will be required to modify the internal arrangement of the modules and to completely layout a printed circuit "master board" in order to provide for a more convenient means to service this unit. 25X1

[ ] has built many systems using the high density packaging techniques suggested in this proposal. Some of the modules which show even higher component densities than those required for the Digital Display Unit are illustrated in Figure 1.

The facts which follow pertain to the re-layout required on the Digital Readout Unit in order to make it more serviceable.

1. [ ] will modify the internal structure of the DR-1 by utilizing a master printed circuit board on which each of the small modules, altered by providing pin-connectors and encapsulating, will be mounted. 25X1
2. The master printed circuit board will have in the order of 100 positions for insertion of all 16 modules.
3. Tentatively, each module will be an encapsulated "throw-away" type.
4. Since there are only in the order of ten connections required from the master printed circuit board to the readout lights battery and ON-OFF control in the front, this can be a miniature connector which has well known, proven, properties like either the Methode or the Elco Models.
5. The smaller modules will have no more than 9 pins to mate to master printed circuit board.

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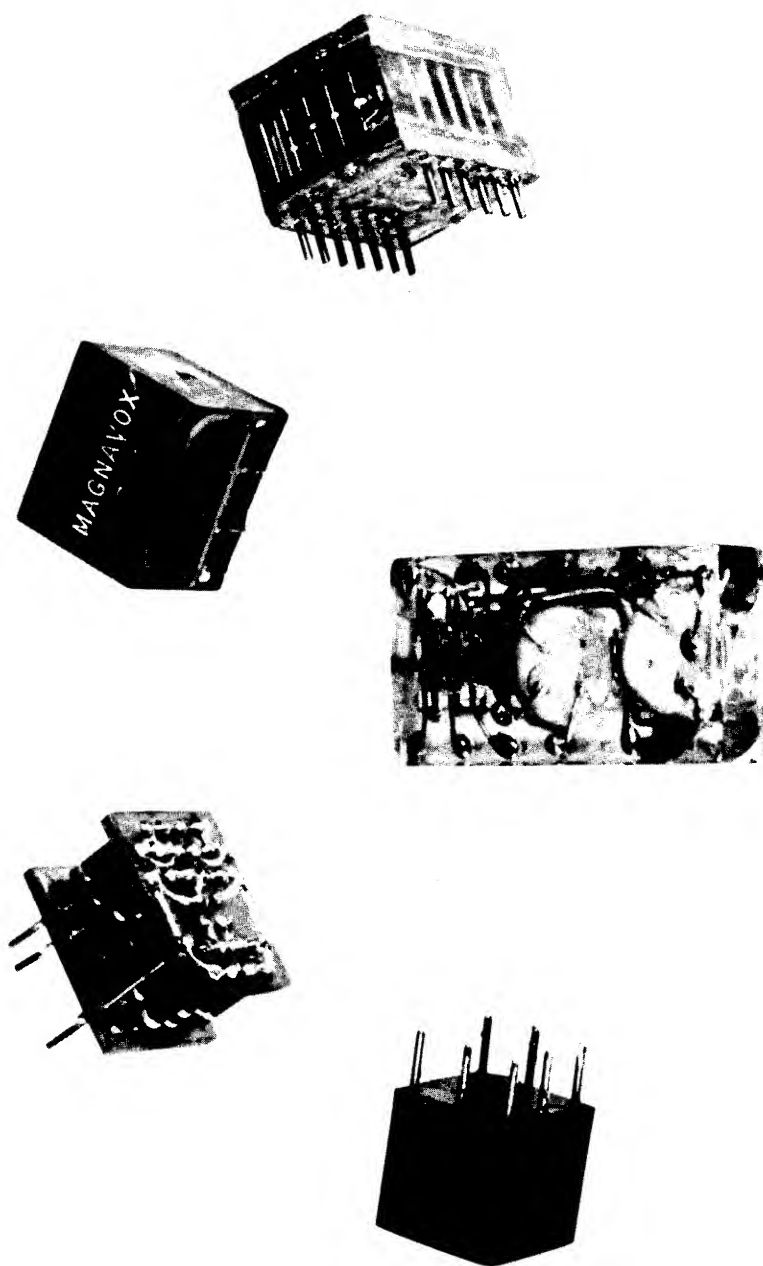


Figure 1. Examples of High Density Modules

6. The larger modules will have no more than 15 pins to mate to master printed circuit board.
7. A jig to test each of the smaller modules and each of the larger modules will be fabricated early in the first phase of this program in order to quickly check modules on the production line.

Whether or not the modules used in the Digital Display Unit will be encapsulated will depend upon whether or not each of the 16 modules will be classified as "throw-away" modules in the field. With the new layout suggested below, these modules can be removed and tested just like testing a vacuum tube in a tester. The symptoms which show a malfunction in the field will suggest which module is at fault. The process of substituting a new module for the bad one can be used and will take in the order of one minute. The encapsulated "throw-away" modules may be carried as spares. It should be noted that the modules cannot be encapsulated if they are to be repaired in the field. Of course, if encapsulation is not allowed, this will limit the ruggedness of the entire readout unit.

Since the modules in production quantities of 1000 will cost only about twenty-five dollars when encapsulated, it is believed by  that the encapsulated modules will definitely be the most reliable, convenient construction. Needless to say, it would cost very close to the modular unit cost to service the unit. This service cost will be relatively high for two reasons:

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1. The service depots where technicians or engineers can replace bad components in the various modules may not be so convenient, consequently, there will likely be costly shipping and handling costs.
2. The average life time of these units will be long; consequently, the modules which become non-functional will be very few within a period of one year (less than 1 per cent are expected to cause trouble within any one-year period when used continuously).

Very little re-layout of components inside the module is expected, since the existing units can be used, but with minor modifications to adapt to the pin connection suggested below.

The cost represented in this proposal includes the labor for new layout designs along with the proper drafting documentation and a revised technical manual.

The picture story of the assembling of major portions of the Digital Display Unit is sketched in Figures 2 through 5.

Note that a representative master board layout has already been designed. This can be modified as required and checked out for the final printed circuit boards within a week's time.

believes that the best method of solving the servicability problem is that of using a printed circuit master board. This master board consists of two layers of 1/16 in. (double-clad) epoxy in order to provide for three layers of printed circuitry which, from calculations, is required to interconnect the 16 modules and to connect to the external portion of the Digital Display Unit for the visual read out. 25X1

As illustrated in Figure 6, this master board overlay of printed circuits will take all of the pins of all 16 modules. The printed circuits will be in three parts. The first layout will be called the top printed circuit; the second, the middle printed circuit; and the third will be the bottom printed circuit. Each pin on the various modules will make good electrical contact to all three layers of printed circuits. The small pins, as noted on the modules in Figures 2 and 3, will be making electrical contact with plated through holes in this master board. As noted in Figure 4, the modules will be inserted onto the master board consecutively. Modules are identified as follows:

- Module 1 — Limiter
- Module 2 — Filter Amplifier No. 1
- Module 3 — Bridges
- Module 4 — Filter Amplifier No. 2
- Module 5 — Detector Schmitt No. 1
- Module 6 — Detector Schmitt No. 2
- Module 7 — B4 Bistable
- Module 8 — B3 Bistable
- Module 9 — B2 Bistable
- Module 10 — B1 Bistable
- Module 11 — Readout Bistable
- Module 12 — Reset Monostable
- Module 13 — Lamp Control
- Module 14 — Lamps No. 1, No. 2, and No. 3 Gate

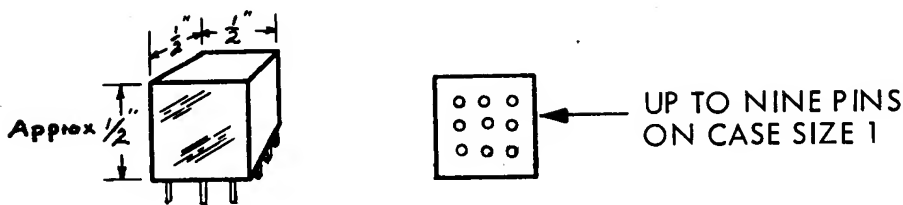


FIGURE 2. SMALL MODULE CONSTRUCTION

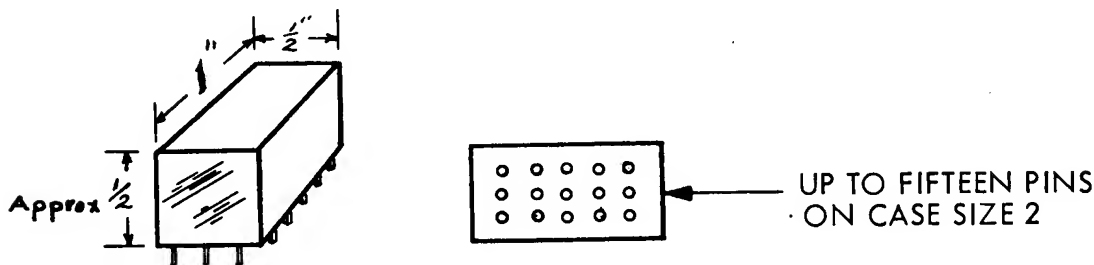


FIGURE 3. LARGE MODULE CONSTRUCTION

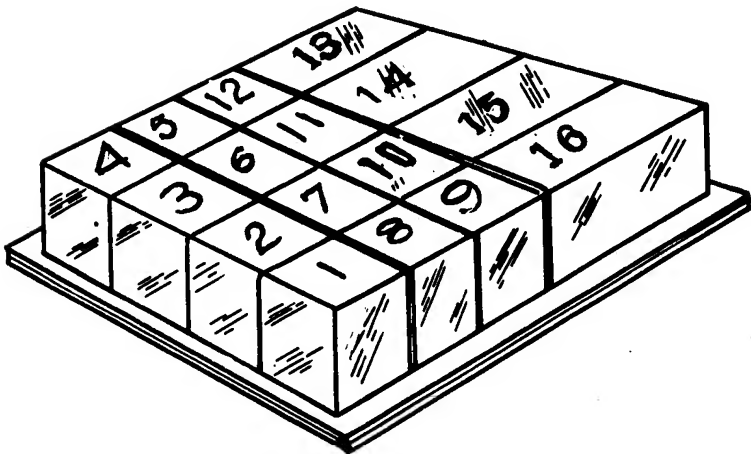


FIGURE 4. MODULES ON MASTER BOARD

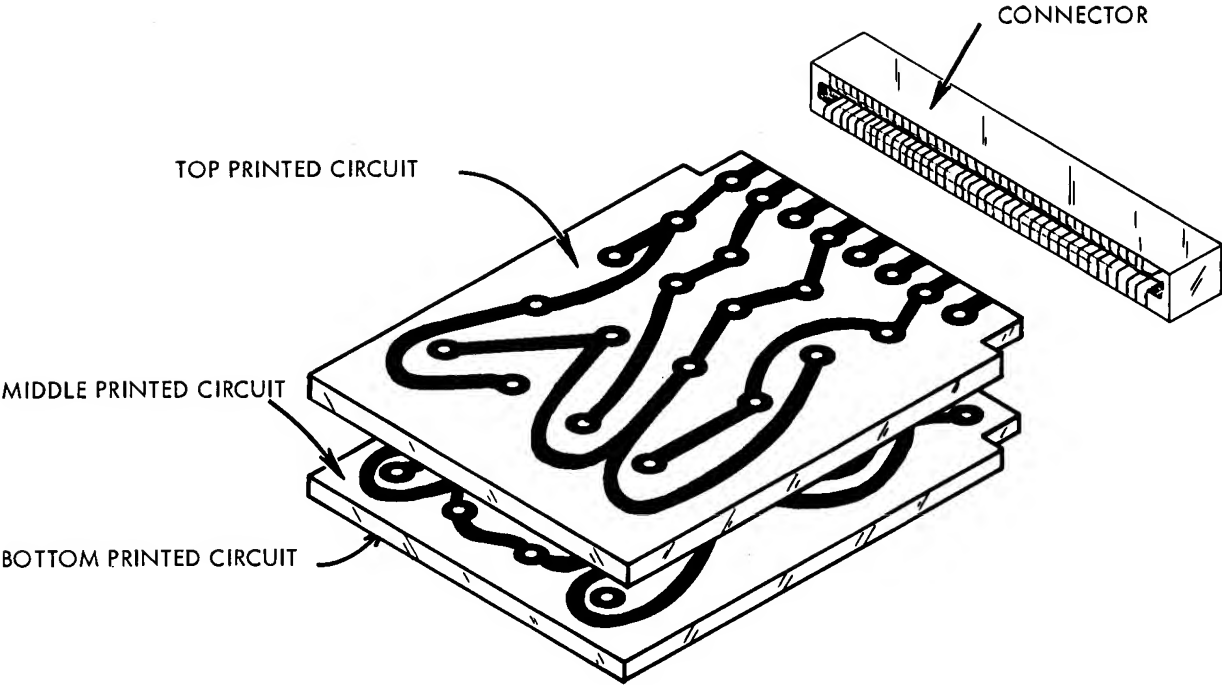
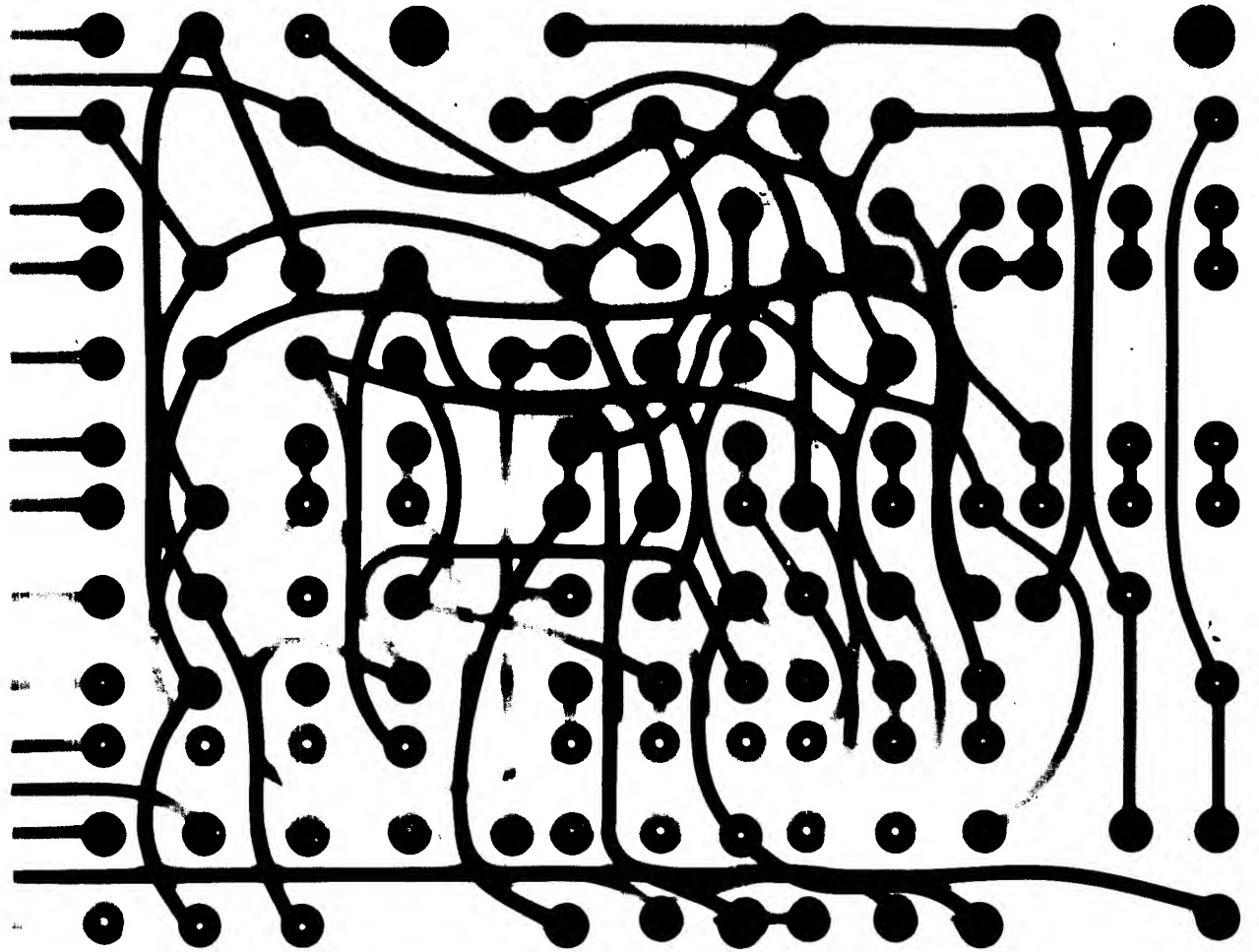


FIGURE 5. DETAILS OF MASTER BOARD



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**TOP PRINTED CIRCUIT**

**MIDDLE PRINTED CIRCUIT**

**BOTTOM PRINTED CIRCUIT**

Figure 6. Printed Circuits

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Module 15 — Lamps No. 4, No. 5, and No. 6 Gate

Module 16 — Lamps No. 7, No. 8, No. 9, and No. 10 Gate

As noted from the figures indicated above, the modified digital readout unit is quite servicable. Any module can be disengaged and a substitute module inserted within a few seconds.

## **Conclusion**

A few concluding remarks will clarify some additional stipulations of this proposal:

1. The master board layouts presented incorporates facts that were available from information as disclosed in the request to bid. There existed several minor points which were not explained or clarified. These are minor though and can be resolved immediately after [ ] is able to scrutinize the 25X1 prototype Digital Display Unit more closely.
2. The material for the 100 Digital Display Units, DR-1, will be ordered the first week after award of contract. In other words, the ordering of materials will not be done piecemeal (the material for five units required in Phase I and for the 95 units required in Phase II will be ordered immediately after award of contract).
3. It is assumed that at least two Digital Display Unit prototypes will be supplied GFE for the duration of the contract (six months).
4. It is assumed that at least one Transmission Adapter Unit will be supplied GFE in order to test the Digital Display Units for functional acceptance.
5. The first five Digital Display Units will be fabricated under engineering surveillance in our Digital Systems Department and released for acceptance to the Government within the first three months period after award of contract. After acceptance, the remaining 95 units will be fabricated, tested, and delivered within the next three months. Consequently, [ ] is pro- 25X1 posing a six month program to manufacture 100 Digital Display Units.

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